

(#11a)

**Visit of the NRC Delegation to Germany**

**SAFETY ASPECTS OF HTR TECHNOLOGY**

**23 to 26 July 2001**

**Contributions to be presented by**

**TÜV Hannover/Sachsen-Anhalt e.V.**

*Nitzki*



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D-23

# Topics - 1

Monday, 23 July 2001

## Overview on Safety Assessment of the HTR Module in Germany

- The contribution of the TÜV to technical safety in Germany
- The role of TÜV Hannover/Sachsen-Anhalt e.V.  
in nuclear technology
- The licensing process for the German HTR-2 NPP



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# Topics - 2

Thursday, 26 July 2001

## Safety Assessment of the HTR Module in Germany

- The task as defined in the contracts
- Overview of the plant concept
- The methodology applied in safety assessment of the HTR-2 NPP
- The most important results



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# Origin of TÜV in Germany

- TÜV founded in the second half of nineteenth century by industrial companies operating steam vessels and engines
  - Aim: Reduction of steam vessel and engine failures
  - Status: Independent and neutral association; regionalized structure
- ⇒ Effect: Distinct reduction of steam vessel and engine failures
- ⇒ Consequence: Enlargement of TÜV tasks

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# **TÜV today - 1**

- The TÜV are a service companies engaged in safety assessment and inspections of technical equipment
- Task: To protect people and the environment from the hazards caused by erection and operation of technical equipment
- TÜV are free from manufacturers', licensees' and buyers' interests; they are independent and self-governing institutions of trade and industry
- Statute: Expertise - Independence - Neutrality

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## TÜV today - 2

- Field of activities:

free market activities



TÜV are service companies carrying out

- ⇒ sovereign tasks for the authorities
- ⇒ consultation tasks for the authorities
- ⇒ consultation tasks for industrial companies

- Spectrum of activities:

- ⇒ Car inspections
- ⇒ Safety of conventional plants
- ⇒ Biotechnology
- ⇒ Environmental protection
- ⇒ Quality management systems
- ⇒ Material investigations
- ⇒ Nuclear safety



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# **TÜV NORD GRUPPE**

- **TÜV NORD GRUPPE:**  
**Merger of TÜV Hannover/Sachsen-Anhalt e.V. and  
TÜV Nord e.V.**
- **Turnover: 800 Million DM per year**
- **4000 employees**
- **Offices in 8 federal states in Germany:**  
**Lower Saxony, Mecklenburg-Vorpommern,  
North-Rhine Westphalia, Sachsen-Anhalt, Schleswig-Holstein,  
Berlin, Bremen and Hamburg**



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# **The Division Energy and Systems Technology**

**Founded:** 1957

**Staff today:** 170 scientists and engineers with expertise in:  
civil engineering, electrical engineering, process  
engineering, mechanical engineering, nuclear  
physics, chemistry, biology

**Organization form:** Matrix structure:  
4 specialists' departments, 1 project department,  
efficient project management, strict separation  
of responsibilities, but team work

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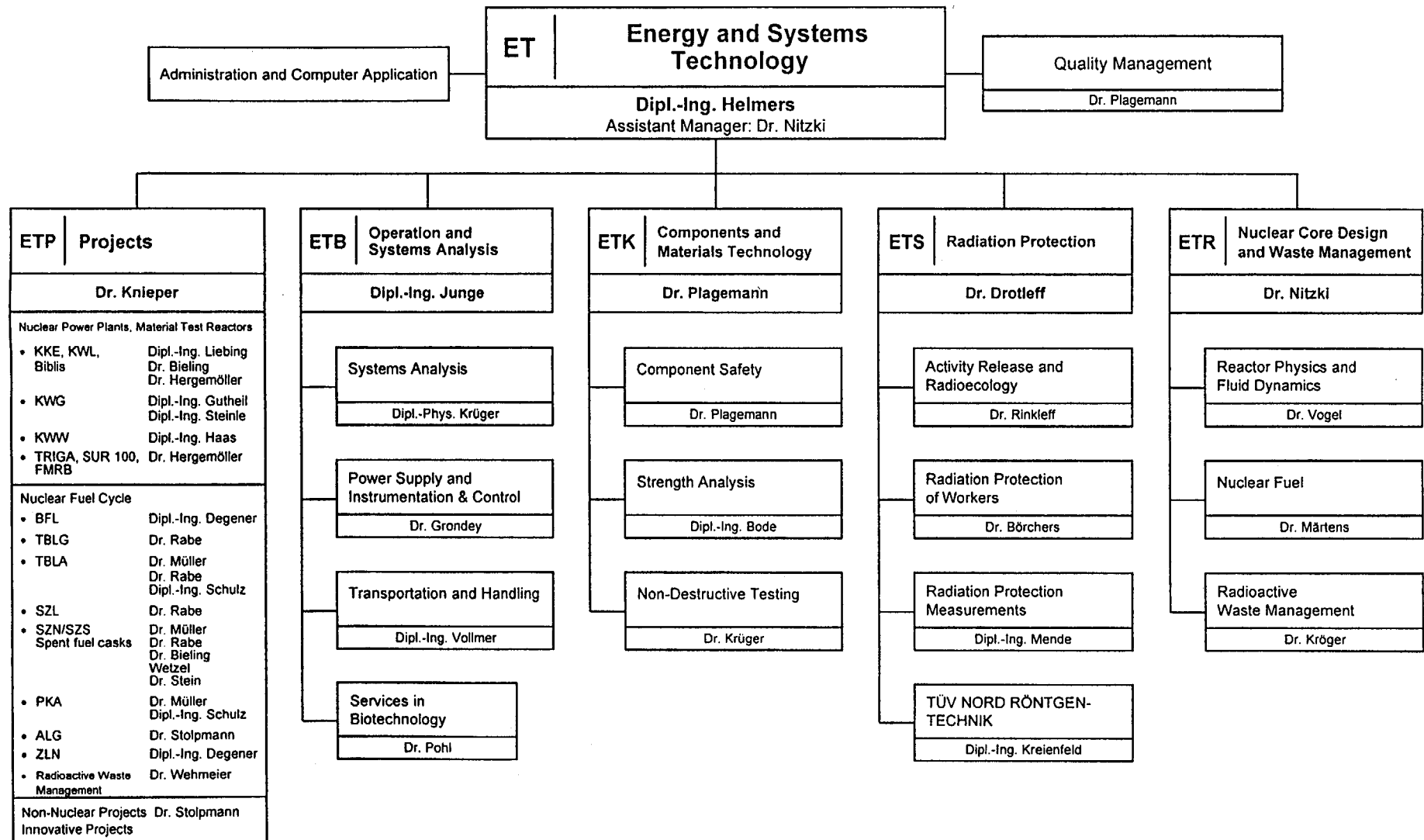
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# TÜV Hannover/Sachsen-Anhalt e.V.

## Division Energy and Systems Technology



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## **Main Projects of the Division**

- **Nuclear Power Plants**
  - ⇒ Operating NPPs: Grohnde, Emsland, Biblis A and B
  - ⇒ Decommissioning: Würgassen, Lingen
- **Fuel Fabrication: Fuel fabrication plant of Framatome/Siemens at Lingen (former Exxon Plant)**
- **Spent Fuel Storage: Ahaus, Gorleben, Greifswald and various On-Site Storage Facilities**
- **Interim and Final Waste Storage: Gorleben, Greifswald, Konrad**
- **Compliance of waste properties and acceptance criteria**
- **Compliance of spent fuel transportation casks and transportation requirements**
- **Others, e.g. German HTR-2 Modular Reactor and Pebble Bed Modular Reactor of ESKOM, South Africa**



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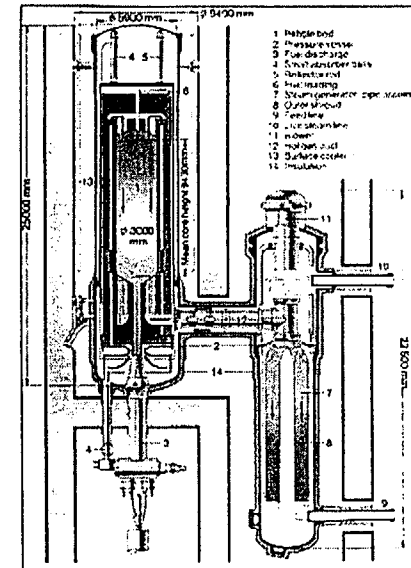
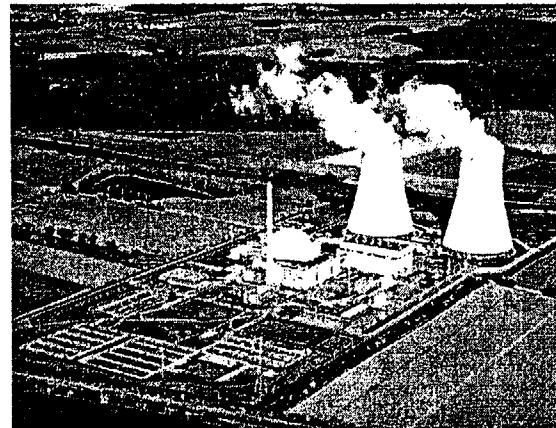
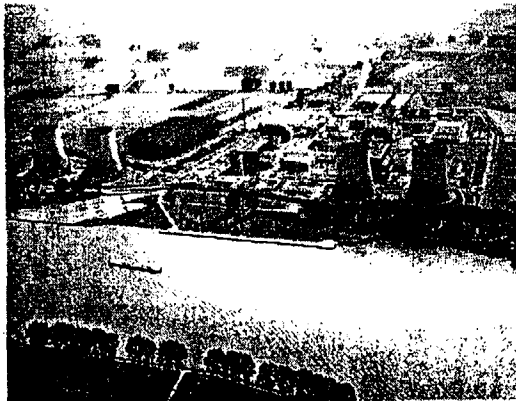
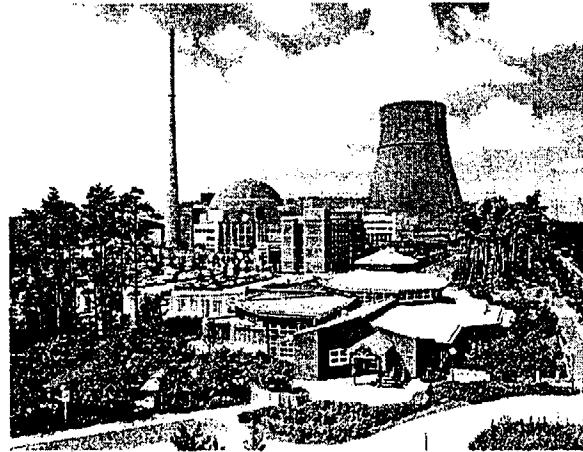
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# Main Projects: Nuclear Power Plants



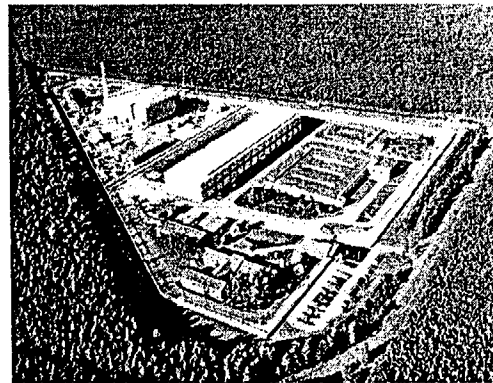
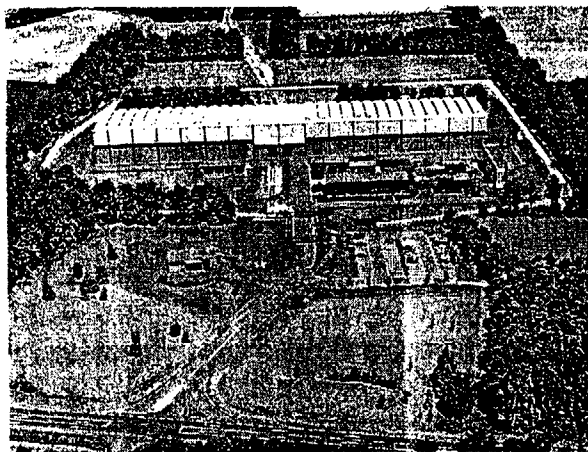
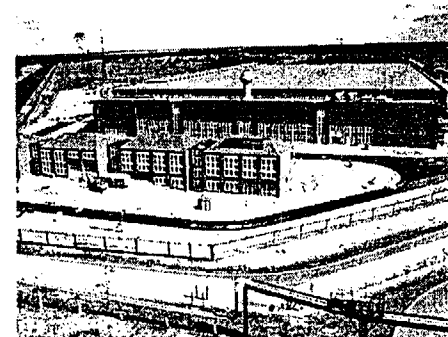
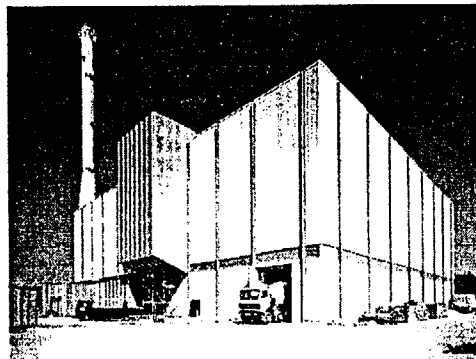
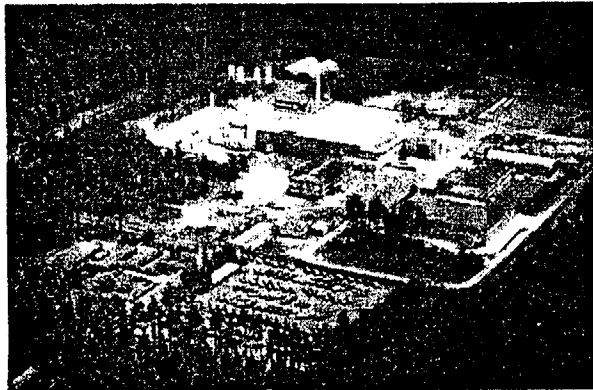
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# Main Projects: Nuclear Fuel Cycle



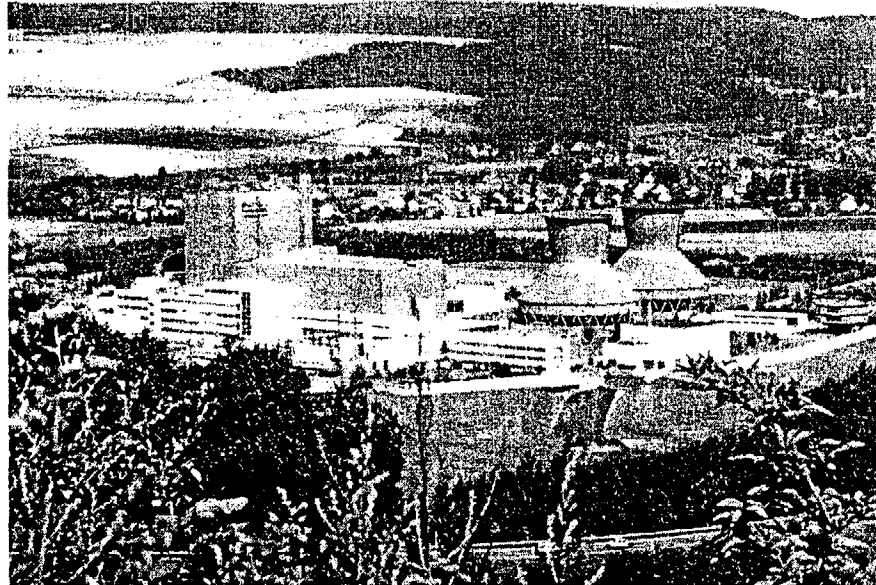
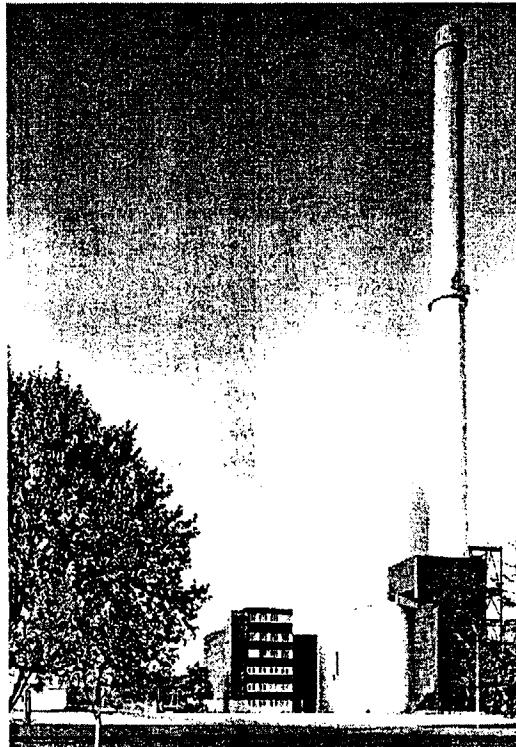
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# Main Projects: Decommissioning



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## **Main Customers**

- **Ministry for the Environment of Lower Saxony**
- **Ministry for Trade and Economics of North-Rhine Westphalia**
- **Hessian Ministry for the Environment**
- **Ministry for the Environment of Mecklenburg-Vorpommern**
- **Federal Agency for Radiation Protection**
- **others, e.g. ESKOM (South Africa)**

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# Legal Background of TÜV Role in Nuclear Technology

- Each nuclear facility                      ⇒      to be licensed according to Nuclear Energy Act
  - §7 of Nuclear Energy Act                      licensing prerequisites
  - Most important prerequisite                      state of science and technology (“state of the art”)
  - Verification of licensing prerequisites                      external experts may assist
  - Technical part of verification                      TÜV as consultant of the authorities
- ⇒ TÜV has complete overview of the technical state of the plant and licensing and surveillance procedures



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# Tasks of TÜV in Nuclear Technology

- Safety assessment preceding erection and operation of nuclear installations, e.g. NPP, Storage Facility
- Surveillance and safety assessment during operation:
  - ⇒ Routine tasks:
    - On-site inspections, e.g. recurrent periodic inspections
    - Evaluation of modifications, e.g. reload patterns
    - Surveillance during plant outages
  - ⇒ Special tasks:
    - Evaluation of incidents
    - Evaluation of the PSA
- Decommissioning of nuclear installations, e.g. NPP

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# Extent of TÜV in Assessment and Surveillance

The following figures are valid for an LWR NPP:

- **Safety assessment and inspections preceding erection and operation: total of ca. 250 man years**
  
- **Surveillance and safety assessment during operation:**
  - ⇒ Routine tasks: total of ca. 20 man years per year
  - ⇒ Special tasks: total of ca. 5 man years per year

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# Steps in NPP Licensing in Germany (Normal Procedure)

- Licensing basis:** § 7 of the Nuclear Energy Act;  
basic requirements to be met by the application
- Application:** To be submitted to the licensing authorities  
by the applicant
- Common practice:** Licensing in consecutive steps (“partial license”)  
◆ concept and buildings  
◆ components and systems  
◆ non-nuclear preoperational tests  
◆ permanent operation license
- During operation:** Licensee can apply for modifications  
of the licensed plant

# **Licensing Procedure for the HTR-2 Modular Reactor**

- **Licensing basis: § 7a of the Nuclear Energy Act (site-independent license)**
- **Extent and content of the application (and license) less than the first partial license in a normal licensing procedure, but exceeding that of a conceptual license**
- **Validity of license limited to a certain time (previsional license)**
- **Licensee not obliged to make use of the licensing decision**



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# Course of the Licensing Process for the HTR-2 NPP

- **April 1987:** Application of Siemens/Interatom for a site-independent license of the German HTR-2 NPP according to § 7a of the Nuclear Energy Act
- **Licensing authority:** Ministry of the Environment of Lower Saxony
- **Expert organization:** TÜV Hannover/Sachsen-Anhalt e.V.
- **April 1989:** Withdrawal of application for political reasons, termination of the licensing process
- **May 1989:** Continuation of safety assessment by TÜV Hannover-Sachsen-Anhalt e.V. under contract of the Federal Ministry for Research and Technology
- **October 1989:** Delivery of TÜV safety assessment report as input for RSK recommendation (May 1990)

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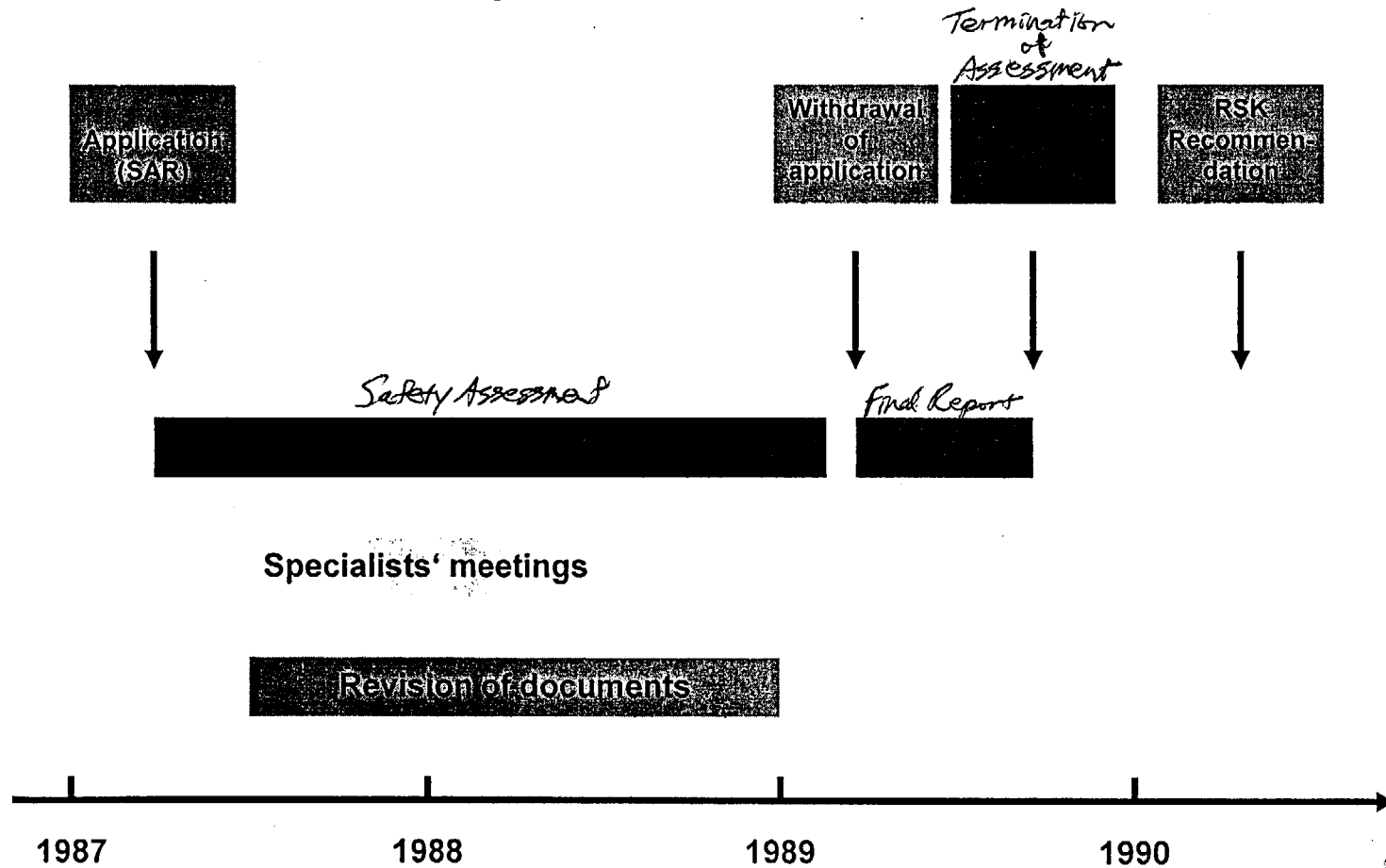
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# Licensing of the German HTR-2 NPP



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# Role of TÜV in the HTR-2 NPP Licensing Process

- **Task:** Safety assessment of concept and design of the HTR-2 NPP
- **Applied method:** Interdisciplinary team - matrix structure – iterative procedure:
  - ⇒ Specialists' meetings in 1987 and first half of 1988
  - ⇒ Revision of licensing documents and completed by applicants early in 1989
  - ⇒ Continuation of assessment in 1989
- **Experts' costs:** Equivalent to 25 man years
- **Result:**
  - ⇒ Complete and consistent review of an advanced HTR concept
  - ⇒ Safety Assessment Report
  - ⇒ Approval of concept by Reactor Safety Commission

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# HTR-Module-Specific Technical Rules

- **Problem:** No technical rules and guidelines for HTR-2 NPP available for design and safety assessment
- **Solution:**
  - ⇒ Screening of existing technical rules and guidelines for LWR
  - ⇒ “Filtering” of HTR-specific aspects
  - ⇒ Consideration of concept-specific features
  - ⇒ Consideration of concept-specific scientific and technical publications
- ⇒ Comprehensive and consistent set of design and evaluation criteria applicable to the HTR-2 NPP
- **Procedure:**
  - ⇒ Derivation and proposal by the applicants
  - ⇒ Verification, modification and approval by the TÜV experts

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# Documentation of the Assessment Results

- **Safety Assessment Report:** ca. 900 pages, in German
- **Summary:** Safety Assessment of the Design of the Modular HTR-2 NPP  
TÜV Hannover, May 1990  
51 pages, in English and German
- **Publication:** H. Helmers and H. Knieper:  
Review of the safety concept of the HTR 2 reactor plant  
Nuclear Engineering and Design  
137 (1992) 89-95

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# **Present Involvement in the HTR Field**

**TÜV Hannover/Sachsen-Anhalt e.V. contracted by ESKOM  
for different tasks in the licensing process of the South African  
Pebble Bed Modular Reactor (PBMR):**

- **Derivation of a safety classification system  
and the integrated design process**
- **Review of Safety Analysis Report, Rev. 0b**
- **To be expected (contract under negotiation):  
Review of Safety Analysis Report, Rev. 1,  
and further QA tasks in the licensing process**

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